Counterspaces that Support Identity Work in Physics

by Allison J. Gonsalves and Hannah R. Chestnutt

Physics continues to lag behind the other sciences in the recruitment and retention of minoritized students like women, and particularly women of colour, to post-secondary degree programs (*e.g.*, [1]). Reports of 'chilly climates' for women [2], unsupportive classroom environments [3], and characterizations of these disciplines as masculine [4,5], have provided speculation as to why the gap persists. Sociocultural researchers have suggested that the development of a science-identity (*e.g.*, [6]) or specifically physics identity (*e.g.*, [7,8]) can influence persistence and success in physics. Researchers have also found that participation in STEM (Science, Technology, Engineering, Mathematics) national groups or campus groups can impact minoritized students' persistence in physics programs (*e.g.,* [9-13]). The focus of recent research has thus been on the link between science-identity formation and the resources students can access through equity, diversity, and inclusion (EDI) initiatives [12], specifically in physics [14].

EDI-focused STEM clubs and programs have been known to influence students positively by opening pathways into STEM fields. Socially and academically supportive networks are built when EDI STEM clubs/organizations allow minoritized students to feel more connected with a community of students with similar interests and experiences, and also more connected with the STEM community at large [9,10]. In particular, deficit notions of minoritized students can be challenged and a positive collegiate racial climate can be established within initiatives that serve as *counterspaces* (*e.g.*, [15]). Counterspaces are described by Ong and colleagues as safe social spaces that "offer support and enhance feelings of belonging in STEM" (p. 207). Solórzano et al. [15] suggests that in these spaces students may vent frustrations by sharing stories; validate their own experiences and learning; and counter deficit notions of minoritized students (especially women of colour). By definition, these 'safe spaces' "lie in the margins, outside of mainstream educational spaces, and are occupied by members of non-traditional groups" [12]. In their research, Ong and colleagues demonstrated that counterspaces offered opportunities for students to vent frustrations and form networks with other students, faculty, staff and other allies who shared students' experiences of microaggressions or discrimination.

Summary

This research essay discusses the potential that counterspaces—safe spaces for minoritized groups in physics—have to support students' persistence in physics. Focussing on undergraduate and graduate learning environments, we describe attributes of counterspaces in physics, and the positive identity resources (relational, ideational and material) students can access through them.

A DEPARTMENT AS A COUNTERSPACE

In physics contexts, counterspaces can provide alternatives to the typical learning space in which there are often limited available identities, and efforts to create a sense of belonging for minoritized students (*e.g.*, [3]). A study by Johnson and colleagues [16] demonstrated that while counterspaces are often situated outside of formal academic spaces, departments themselves can be structured to act as counterspaces. Johnson and colleagues identified various features of a physics department shown to act as a counterspace for women of colour in physics. First, students reported that rather than isolation (a common experience for minoritized students in physics), they found friendship and support in the department. This was significant for students, especially women of colour, who often find themselves feeling alone in departments that are predominately populated by men. Minoritized students also reported that they trusted that their professors would deal with microaggressions so that they didn't have to. Microaggressions are so prevalent in physics cultures that they are thought to be a significant factor in attrition from graduate programs for women of colour (*e.g.*, [17]). Students trusted that their professors would address microaggressions in classes, or pull aggressors aside to confront their behaviour. This created a culture of safety in the classroom and facilitated a sense of belonging for minoritized students. Finally, Johnson and colleagues report that professors in this department went out of their way to create a sense of community among students — a strategy that is counter to the cultural expectations for physics departments that have historically been constructed as competitive and individualistic [5,18].

Allison J. Gonsalves <allison.gonsalves@mcgill.ca>
Assistant Professor,
Department of Integrated Studies in Education,
Faculty of Education,
McGill University,
Montreal, Quebec

Hannah R. Chestnutt <hannah.chestnutt@mcgill.ca>
Faculty Lecturer,
Faculty of Education,
McGill University,
Montreal, Quebec

A department as counterspace created opportunities for students to interact with each other and with professors outside of class time. Students were encouraged to present their own work frequently, and public spaces were provided for students to work together, in consultation with faculty members. Johnson and colleagues argue that for this department to be a counterspace, the departmental members "don't just leave it to chance that underrepresented students will get knit into this community" (p. 359).

A COUNTERSPACE EMBEDDED IN A DEPARTMENT

Our own research with an EDI group for faculty and students in a physics department suggests that counterspaces for students (and faculty) provide various resources that can facilitate students' positive identity work in physics. Our study (see [14]) investigated the resources made available through an EDI group (formerly known as a Women in Physics group) in a physics department at a large, research-intensive university. This EDI group is chaired by a faculty member from the department, and is provided with financial resources to fund teaching assistants who run various aspects of the group (outreach and communications/event planning). The group was established as a working committee to address issues of harassment, microaggressions, isolation and imposter syndrome (*e.g.*, [19]) that students experienced in the department. However, our research suggests that although this group was established as a departmental working group, for the students participating in it, it operated as a counterspace. This is a positive example of a counterspace that can become embedded in the departmental structure of a physics unit in ways that provide *relational*, *ideational,* and *material* resources [20] to students. Our analysis suggests that the counterspace provides relational resources in the form of access to faculty members outside of class and laboratory time. The counterspace acted to flatten the prevailing hierarchical structure in the department, and provided opportunities for faculty, students and staff to interact informally in new ways. Social activities provided students with new opportunities to relate to faculty, and to approach them with issues related to being a minoritized student in a department with predominantly male students and faculty. These new relationships brokered ideational resources for minoritized students. Whereas celebrated physicist identities tend to be associated with traits like competitiveness, brilliance, and solitary social behaviour [9,21], students reported being able to see themselves as physicists who are also empathetic community builders. Thus, the EDI group broadened the kinds of physicist identities that were available to minoritized students and others in the physics department, and also what kind of identities were valued by its members. The counterspace also provided material resources to students in that teaching assistantships were funded to allow students to do the important work of organizing inreach and outreach that supported others. Funding for the EDI group was provided by the department and was critical for its functioning. Workload credit was also granted to faculty members who played organizing roles within the group.

CONCLUSION

To be successful, institutionally-led counterspaces require the allocation of both human and financial resources. Both of these types of resources are needed for the creation of forms of engagement that support students and their relationships with faculty and with one another. Critical to the success of both of the counterspaces described in this short paper were the commitments that institutions made to ensuring that faculty and staff responded to students in ways that validated their experiences. Faculty and staff were resourced in ways that promoted their own abilities to deflect episodes of microaggressions away from minoritized students, and to combat isolation by ensuring that minoritized students had opportunities to engage with each other and opportunities to access supportive faculty members outside of class time. It is important to note that the success of these programs cannot rest on a single faculty member or administrator. Our analysis [14] suggested that EDI groups like the WPG could be fragile in structure, if tasks and leadership roles are not distributed across several faculty members and staff. The removal of key faculty members or administrators from leadership positions within the EDI group could lead to a vacuum of information and support. Thus, the responsibility to initiate and maintain a successful EDI counterspace requires commitment from many members of the physics department. This can be enabled by allocating financial resources (as in paid student leadership positions, workload credit for faculty members, and workload allocation for staff members) to the operations of the group. It should also entail rotating leadership roles to ensure that responsibilities are distributed, and structural holes are not formed when members leave (graduation, sabbatical, etc.). While counterspaces tend to exist on the margins of mainstream educational spaces, the two examples described here demonstrate how it is possible to establish these spaces within the structure of the traditional physics department. The benefits to students are numerous, but most notably, it can create an opportunity for minoritized students to feel safe in often hostile physics learning environments, and to begin to imagine physics futures for themselves.

REFERENCES

1. Ivie, R., and Tesfaye, C.L. "Women in physics", *Phys. Today*, **65**(2), 47 (2012).
2. Clark Blickenstaff, J. "Women and science careers: Leaky pipeline or gender filter?" *Gender and Education*, **17**(4), 369-386 (2005). https://doi.org/10.1080/09540250500145072.

3. Hasse, C. "Gender Diversity in Play With Physics: The Problem of Premises for Participation in Activities", *Mind, Culture, and Activity*, **9**(4), 250-269 (2002). https://doi.org/10.1207/S15327884MCA0904_02.
4. Gonsalves, A.J., Danielsson, A., and Pettersson, H. "Masculinities and experimental practices in physics: The view from three case studies", *Physical Review Physics Education Research*, **12**(2), 020120 (2016).
5. Traweek, S. *Beamtimes and lifetimes*. Harvard University Press (1988).
6. Carlone, H.B., and Johnson, A. "Understanding the science experiences of successful women of color: Science identity as an analytic lens", *Journal of Research in Science Teaching*, **44**(8), 1187-1218 (2007). https://doi.org/10.1002/tea.20237.
7. Danielsson, A.T. "Exploring woman university physics students 'doing gender' and 'doing physics'", *Gender and Education*, **24**(1), 25-39 (2012). https://doi.org/10.1080/09540253.2011.565040.
8. Gonsalves, A.J. "Physics and the girly girl—There is a contradiction somewhere: Doctoral students' positioning around discourses of gender and competence in physics", *Cultural Studies of Science Education*, **9**(2), 503-521 (2014).
9. Chang, M.J., Sharkness, J., Hurtado, S., and Newman, C.B. "What matters in college for retaining aspiring scientists and engineers from underrepresented racial groups", *Journal of Research in Science Teaching*, **51**(5), 555-580 (2014).
10. Espinosa, L. "Pipelines and Pathways: Women of Color in Undergraduate STEM Majors and the College Experiences That Contribute to Persistence", *Harvard Educational Review*, **81**(2), 209-241 (2011). https://doi.org/10.17763/haer.81.2.92315ww157656k3u.
11. Garcia, G.A., and Hurtado, S. *Predicting Latina/o STEM persistence at HSIs and non-HSIs*, University of California, Los Angeles 2011.
12. Ong, M., Smith, J.M., and Ko, L.T. "Counterspaces for women of color in STEM higher education: Marginal and central spaces for persistence and success", *Journal of Research in Science Teaching*, **55**(2), 206-245 (2018). https://doi.org/10.1002/tea.21417.
13. Palmer, R.T., Maramba, D.C., and Dancy, T.E. "A Qualitative Investigation of Factors Promoting the Retention and Persistence of Students of Color in STEM", *The Journal of Negro Education*, **80**(4), 491-504 (2011).
14. Gonsalves, A.J., and Chestnutt, H.R. "Networks of Support: Investigating a Counterspace that Provides Identity Resources for Minoritized Students in Post-Secondary Physics", *The Physics Teacher*, **58**(5), 324-327 (2020).
15. Solorzano, D., Ceja, M., and Yosso, T. "Critical Race Theory, Racial Microaggressions, and Campus Racial Climate: The Experiences of African American College Students", *The Journal of Negro Education*, **69**(1/2), 60-73 (2000).
16. Johnson, A., Ong, M., Ko, L.T., Smith, J., and Hodari, A. "Common challenges faced by women of color in physics, and actions faculty can take to minimize those challenges", *The Physics Teacher*, **55**(6), 356-360 (2017).
17. Barthelemy, R.S., McCormick, M., and Henderson, C. "Gender discrimination in physics and astronomy: Graduate student experiences of sexism and gender microaggressions", *Physical Review Physics Education Research*, **12**(2), 020119 (2016). https://doi.org/10.1103/PhysRevPhysEducRes.12.020119.
18. Pettersson, H. "Multiple Masculinities and Gendered Research Personas: Between experiments, career choice and family", *International Journal of Gender, Science and Technology*, **10**(1), 108-129 (2018).
19. Ivie, R., White, S., and Chu, R.Y. "Women's and men's career choices in astronomy and astrophysics", *Physical Review Physics Education Research*, **12**(2), 020109 (2016).
20. Nasir, N.S., and Cooks, J. "Becoming a hurdler: How learning settings afford identities", *Anthropology and Education Quarterly*, **40**(1), 41-61 (2009).
21. Francis, B., Archer, L., Moote, J., de Witt, J., and Yeomans, L. "Femininity, science, and the denigration of the girly girl", *British Journal of Sociology of Education*, **38**(8), 1097-1110 (2017).